

A TAXONOMIC STUDY OF *BRACHISTA*
(HYMENOPTERA: TRICHOGRAMMATIDAE) WITH A DESCRIPTION OF
TWO NEW SPECIES PHORETIC ON ROBBERFLIES OF THE
GENUS *EFFERIA* (DIPTERA: ASILIDAE)

JOHN D. PINTO

Department of Entomology, University of California, Riverside, California 92521.

Abstract.—The New World genus *Brachista* Walker is reviewed and its position within the Trichogrammatidae discussed. Three species are included, *B. fidae* (Ashmead), *B. efferiae* Pinto, n. sp., and *B. fisheri* Pinto, n. sp. The two new species are phoretic on Asilidae (genus *Efferia*). Descriptions, a key to species, and a summary of known biological data are included.

Key Words: Trichogrammatidae, *Brachista* taxonomy, phoresy, Asilidae, *Efferia*

Brachista Walker is a small genus of Trichogrammatidae occurring in North, Central and South America. Three closely related species are included, *B. fidae* (Ashmead) and two new species, *B. efferiae* Pinto and *B. fisheri* Pinto, described below. *Brachista fidae* is reported to parasitize eggs of Coleoptera and Homoptera. Hosts of the new species are unknown. A phoretic association with adult *Efferia* suggests that they parasitize eggs of robberflies. Although other genera of Trichogrammatidae are phoretic on Lepidoptera and Orthoptera (Yoshimoto 1976), this is the first report of such a relationship with Diptera. This paper details the taxonomic, distributional and biological data available on *Brachista*. The relationship of the genus to other trichogrammatid genera also is discussed.

Workers have previously used the name *Giraultiola* Nowicki for *fidae*, while assigning an unrelated group of Palearctic species to *Brachista* (Nowicki 1936, Doutt and Viggiani 1968, Yousuf and Shafee 1986). The inappropriateness of these assignments was recently discussed (Pinto 1993). Because *fi-*

diae clearly is the type species of *Brachista*, nomenclatural convention mandates the generic definition utilized here.

Brachista Walker

Brachista Walker 1851: 213. Pinto 1993: 298. Type species: *Brachysticha fidae* Ashmead, by subsequent monotypy.

Brachysticha Foerster 1856: 88. Ashmead 1894: 171. Unjustified emendation of *Brachista*.

Giraultiola Nowicki 1936: 136. Doutt & Viggiani 1968: 552. Yousuf and Shafee 1986: 17. Type species: *Brachysticha fidae* Ashmead by monotypy.

Giraultia: Steffan 1954: 669. Subsequent misspelling of *Giraultiola*.

Elongate, relatively narrow trichogrammatids, gaster elongate, evenly tapered to apex; head broad, slightly wider than thorax. Primarily yellow brown or brown with a pale midline along mesoscutum and scutellum, and a pair of darker elongate maculae on terga I-IV of gaster. Eyes reddish. Body length 0.6-0.8 mm. Fig. 1.

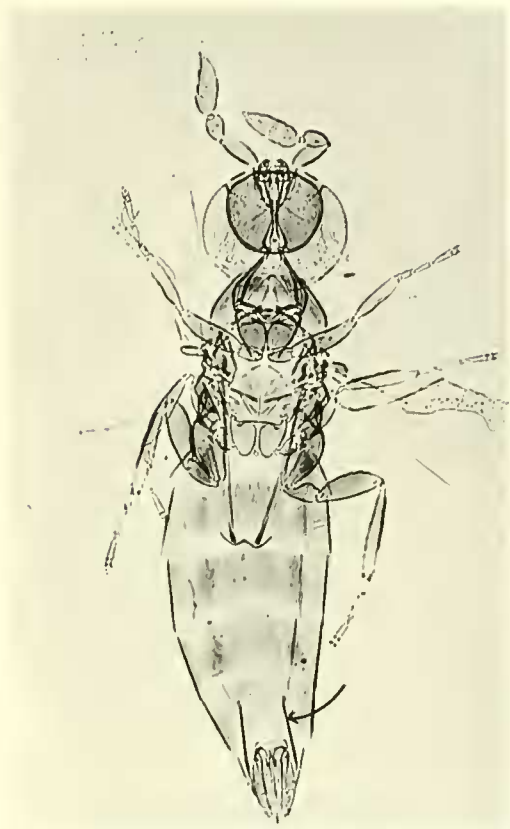
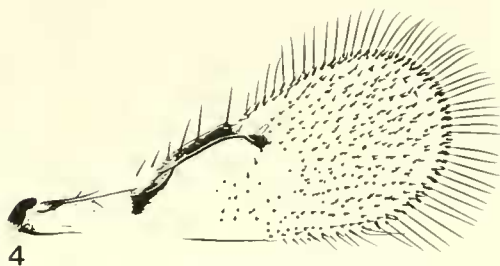
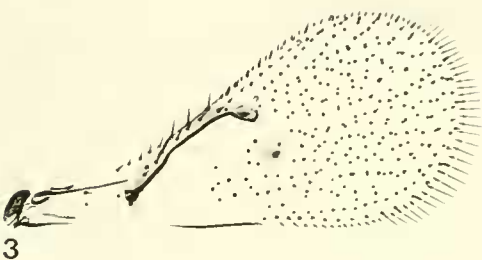


Fig. 1. *Brachista fidiæ*, female (110 \times), mounted in Canada balsam (focusing on ventral surface); arrow points to gastral apodeme.

Antenna with two anelli (A) and a four-segmented, fusiform club (C), widest at C2, club length ca. $\frac{1}{2}$ that of entire antenna, C1 slightly separated from rest of club in some specimens; funicle absent. Mandible tridentate. Maxillary palp one segmented. Mesoscutum and scutellum each with 2 pair of strong setae. Mesophragma elongate, ca. twice as long as wide, evenly tapering posteriorly, emarginate apically (Fig. 1). Forewing (Figs. 2–4) with slight fumation beneath venation; moderately wide, 0.4–0.5 as wide as long; setation on apical half of wing surface dense, not obviously arranged in linear vein tracks, without setae immediately beneath venation, RS_1 absent or



Figs. 2–4. Fore wings of *Brachista*. 2, *B. fidiæ*; 3, *B. efferiæ*; 4, *B. fisheri*.

poorly indicated; venation extending ca. half length of wing; premarginal and marginal vein relatively straight in combination; marginal vein moderately elongate, 1.2–1.5 length of premarginal vein and 2.0–2.7 length of stigmal vein; marginal vein terminating abruptly; stigmal vein distinct, moderately and gradually constricted to base, directed posterolaterally. Hindwing with three complete setal tracks extending from hamuli to apex. Ovipositor very short, length much less than half gaster length, much shorter than hindtibia, retracted within gaster but entire mechanism apparently protrusile. Gaster unique, with two elongate, ventrolateral strutlike apodemes (Fig.

1) extending anteriorly from near apex of sternum VII to sternum VI (apodemes positioned immediately lateral to ovipositor when it is completely retracted in gaster; at full protrusion of ovipositor the posterior end of apodemes are at level of gonangulum); sternum VII very narrowly divided longitudinally.

Male genitalia (Figs. 10, 11) as in the Chaetostrichini (see Viggiani 1971); short, length only slightly greater than half hind tibial length; phallic structures including aedeagus fused into a tubular structure; parameres and volsellae absent; with a well developed anterodorsal aperture (AAD of Viggiani 1971).

Relationships and diagnosis: The current classification of the Trichogrammatidae is based primarily on male genitalia (Viggiani 1971). On this basis *Brachista* is tentatively assigned to the Chaetostrichini, a tribe of Oligositinae in which the anterodorsal aperture of the genital capsule is strongly differentiated. Within this group *Brachista* is most similar phenetically to *Uscana*. Both have the same antennal formula, and similar venation and male genitalia. *Brachista* differs considerably, however in overall body shape (more slender than *Uscana*), absence of a distinct RS_1 and other linear setal tracks (present in *Uscana*), the unique gastral apodemes, and the apparently protrusile ovipositor.

The ovipositor of *Brachista* appears to be unique within the Trichogrammatidae. Unlike other genera, its position in slide-mounted specimens varies from complete retraction within the gaster to complete protrusion. Only the apodemes remain fixed. This suggests that the ovipositor is not attached to the terminal gastral segments and that musculature associated with the apodemes is responsible for protrusion and/or retraction of the entire ovipositor. This may be analogous to that described in certain genera of Scelionidae by Austin (1983). The presence of gastral apodemes clearly is de-

rived and distinguishes *Brachista* from all other Trichogrammatidae.

KEY TO THE SPECIES OF *BRACHISTA* (FEMALES)

1. Segment IV of antennal club (Fig. 5) asymmetrical in lateral view, with several relatively short, curved setae on ventral surface. Claws normal, not strongly decurved, not distinctly lobed (Fig. 15). Outer plate of ovipositor emarginate posteriorly (Fig. 12). Not known to be phoretic on robberflies *fidiae* (Ashmead)
- Segment IV of antennal club (Fig. 7) symmetrical, setae similar on all surfaces. Claws strongly decurved, distinctly lobed (Fig. 16). Outer plate of ovipositor emarginate posterolaterally (Figs. 13, 14). Phoretic on robberflies 2
2. Fore wing (Fig. 3) almost $\frac{1}{2}$ as wide as long; length of longest fringe setae on wing no more than $\frac{1}{4}$ maximum wing width. Hind femur not inflated (Fig. 8), its width distinctly less than $\frac{1}{2}$ its length. Southern United States to Central America *efferiae* n. sp.
- Fore wing (Fig. 4) narrower, distinctly less than $\frac{1}{2}$ as wide as long; length of longest fringe setae on wing longer, at least $\frac{1}{3}$ maximum wing width. Hind femur inflated (Fig. 9), its width about $\frac{1}{2}$ its length. Brazil *fisheri* n. sp.

Brachista fidiae (Ashmead)

Brachysticha fidiae Ashmead, 1894: 171.
Webster, 1894: 169.

Brachystichta fidiae: Webster, 1896: 69
(misspelling of *Brachysticha*).

Lathromeris cicadae Howard, 1898: 102.
Marlatt, 1898: 97, 1907: 130. Girault, 1911: 71; 1918: 7.

Brachista fideae: Girault, 1907: 29 (misspelling of *fidiae*).

Lathromeris fidiae: Johnson & Hammar, 1910: 57. Girault, 1911: 69.

Giraultiola fidiae: Nowicki, 1936: 136. Doutt & Viggiani, 1968: 552.

Length 0.6–0.8 mm, width ca. 0.2 mm.
Head broad, ca. 1.1 greatest width of thorax.

Color: Head light to golden yellow above eyes, dark brown below. Antenna light yellow. Eyes dark red. Thorax brown with narrow yellow-brown longitudinal line at middle of mesoscutum and scutellum, and along

notauli; scutellum paler than mesoscutum; metanotum and propodeum yellow-brown. Gaster yellow-brown to brown, somewhat darker anteriorly. Venter yellow-brown. Legs brown except base and apex of femora and tibiae and entire tarsi light yellow. Wings not fumate.

Female: Antenna (Fig. 5) with relative length/width of scape, pedicle and club 45/15:27/18:59/22; club elongate, relative length of segments 4:3:3:4; C4 asymmetrical in lateral view, dorsal surface straight, ventral surface asymmetrically convex; C1 & C2 with several short unsocketed sensilla; C2 & C3 with several pale, relatively elongate setae; ventral surface of C4 with 8–18 pale, shorter setae curving toward apex of segment; with 1, 1, 2, 3 linear placoid sensilla on C1–C4, respectively, and at least 1 basiconic sensillum at apical margin of each club segment; longest seta on club ca. 1.2 length of C3.

Mesoscutum and scutellum weakly sculptured, each with two pair of narrow, elongate setae, posterior pair closer to midline than anterior pair. Forewing (Fig. 2) 0.45–0.55 as wide as long; longest fringe setae ca. 0.15 maximum wing width; wing densely setose, resulting in linear setal tracks being poorly delimited; setation on disc short and pale. Marginal vein relatively elongate, ca. 1.4 length of premarginal and ca. 2.7 length of stigmal vein; stigmal vein slightly constricted at base; premarginal vein usually with one seta. Hindwing relatively narrow, with 3 complete setal tracks, setae of posterior track shortest. Legs slender, with relative length of femora, tibiae and tarsi as follows: fore- 70:62:(12:20:18), mid- 68:80:(18:22:18), hind- 70:98:(16:22:20); width of hindfemur 0.4 its length. Claws (Fig. 15) normal, not decurved, perpendicular to longitudinal axis of leg, poorly sclerotized, lobe subtending claw relatively small, not fused to ventral surface of claw.

Ovipositor (Figs. 1, 12) occupying ca. 0.3 length of gaster, 0.72–0.85 as long as hind-

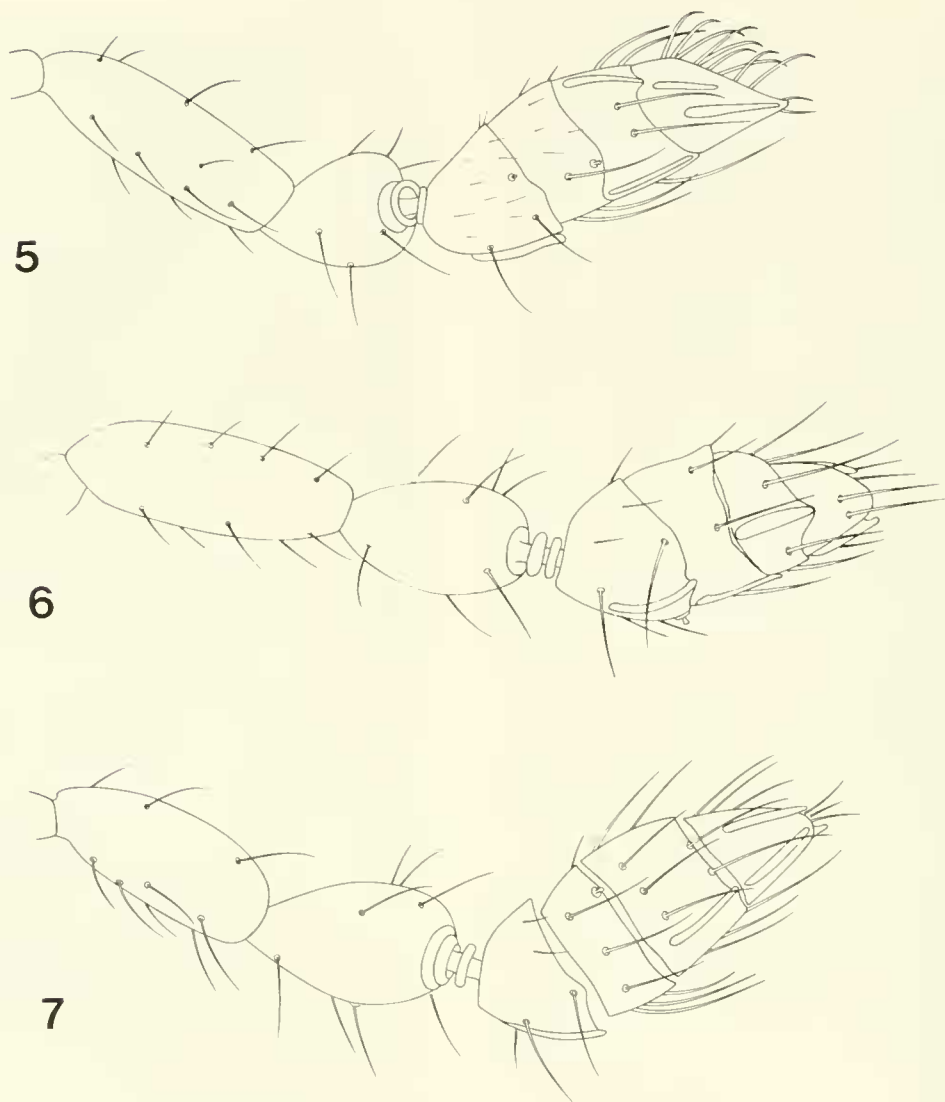
tibia (relative length usually greater in smaller specimens); outer plate (tergum IX) with posterior margin distinctly emarginate, extending ca. $\frac{2}{3}$ length of ovipositor; gonostylus relatively elongate, narrowly attenuate; gastral apodemes well developed.

Male: As in female except antennal club (Fig. 6) suboval in shape, C4 subconical, symmetrical and lacking the modified apicoventral surface and associated curved setae; setation generally shorter and more robust; C1–4 with 1, 1, 1, 2 linear placoid sensillae, respectively. Genitalia as in Fig. 10, length 0.62 hindtibial length, not wider apically than near base.

Diagnosis: The asymmetrical antennal club in females with curved apicoventral setae on C4, the longer ovipositor with its posteriorly emarginate outer plate, and the simple claws separate *B. fidae* from *B. efferiae*, n. sp. and *B. fisheri*, n. sp.

Type information: *Brachysticha fidae* Ashmead: Syntype ♂?; Euclid, Ohio; July 1894; from eggs of *Fidia viticida* on grapevine; F. M. Webster, collr.; United States National Museum (USNM) No. 1448, examined. All that remains of this specimen is a fore and hindwing, and part of the thorax, now mounted under two coverslips on a glass slide in Canada balsam. Girault (1911) examined two "tagmounted specimens labelled type No. 1448." He reported the female missing and that only the forewing remained of the male. Ashmead's description suggests that the type series included more than one specimen but appears to be based on the female (one?) only. No mention is made of males. It is not possible to verify the sex of the syntype examined. It is not designated lectotype because of the remote possibility that undamaged specimens from the type series still exist.

Lathromeris cicadae Howard: Lectotype ♀, herein designated; Virginia, "just across the Potomac River from the City of Washington, in July, 1895"; from eggs of *Cicada septendecim*; T. Pergande collr.; USNM No.

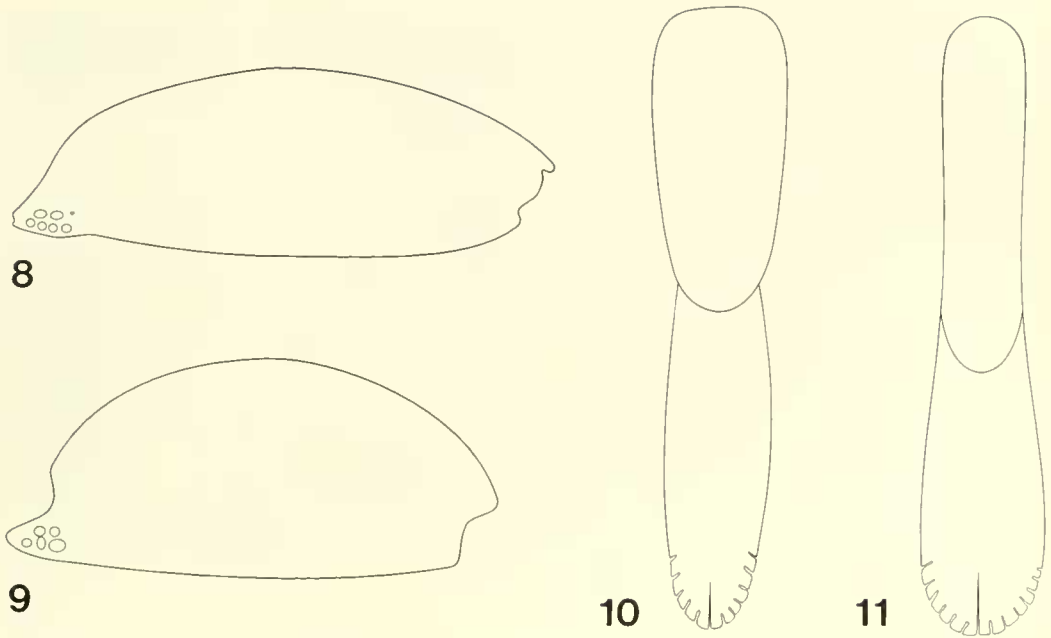


Figs. 5-7. Antennae of *Brachista* (club in lateral view). 5, *B. fidiac* (female); 6, *B. fidiac* (male); *B. efferae* (female).

3850, examined. The lectotype is on a glass slide with three other conspecifics (1 ♀, 2 ♂). The specimen chosen as lectotype is the female mounted in a dorsoventral position (the second female is mounted on its side).

Hosts: The type series of *B. fidiac* emerged from eggs of the grape rootworm (*Fidia viticida* Walsh) (Coleoptera: Chrysomelidae) on grape vines in Ohio (Ashmead 1894). Webster (1894) observed parasitization on

this host and recorded a developmental time to adult emergence of 21 days. The species was reported from this same host in Pennsylvania by Johnson and Hammar (1910). The species apparently also can be a severe parasite of eggs of the periodical cicada [*Magicicada septendecim* (L.)] (Homoptera: Cicadidae) (Marlatt 1898). Specimens emerging from cicada eggs were described as a distinct species by Howard (1898).



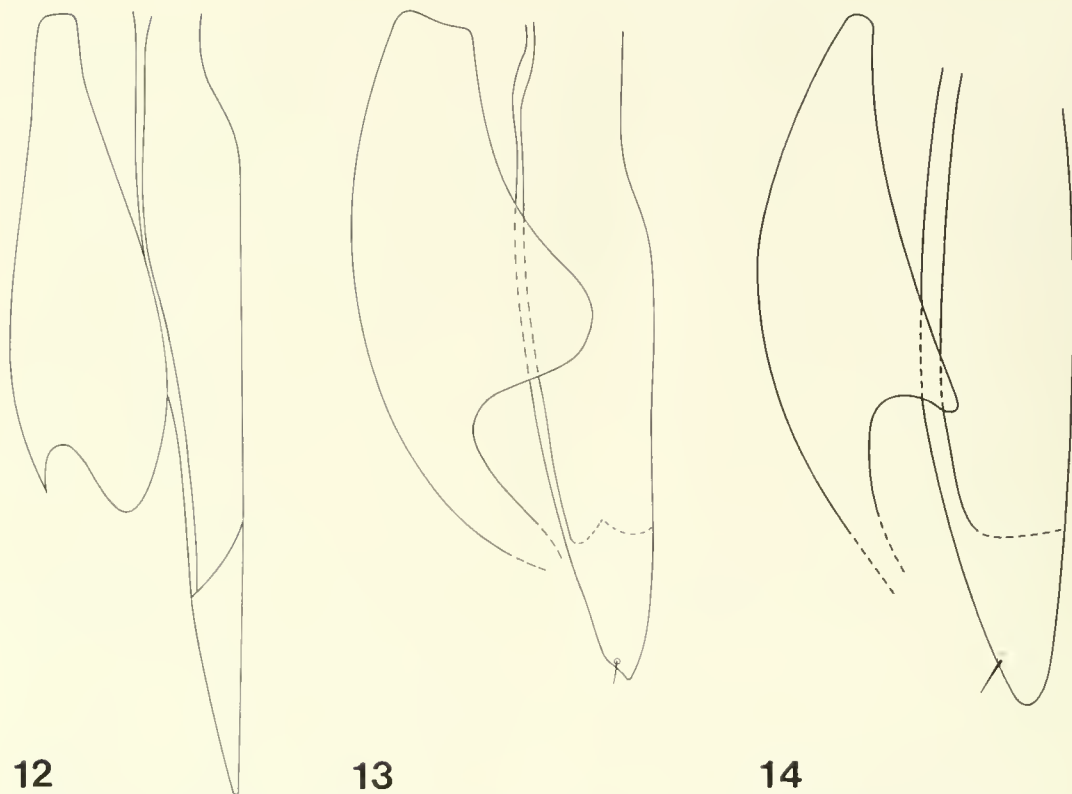
Figs. 8–11. 8, hind femur *B. efferae* (female, base at left); 9, hind femur *B. fisheri* (female, as in 8); 10, male genitalia *B. fidae* (base above); 11, male genitalia *B. efferae* (as in 10).

Geographic distribution: Eastern and southwestern United States with individual records from central Mexico and Costa Rica.

Records: 18 ♀, 11 ♂. COSTA RICA. *San Jose:* Ciudad Colon; 800 m; 1 ♀; iii/iv-1990; L. Fournier & P. Hanson. MEXICO. *Jalisco:* Magdalena, 7 mi. W.; 1 ♀; x-26-1982; sweeping; J. T. Huber. *Morelos:* Tlayacapan; 1 ♀; x-29-1982; sweeping; J. T. Huber. UNITED STATES. *Arizona:* Bisbee, 2 mi. E. (jct. Hwy. 80 & Warren Rd.); 2 ♀, 2 ♂; viii-27-1982; sweeping; J. LaSalle. *Sycamore Cyn.* (Santa Cruz Co.; 9 mi. W. Pena Blanca Lake); 4100 ft.; 2 ♀, 2 ♂; vii-12-1983; R. Anderson. *California:* Anza Borrego State Pk. (Coyote Cyn., 550 ft.); 1 ♀; iv-20-1982; J. B. Woolley. *Menifee Valley*, hills on W. end (Riverside Co.); 1 ♀; ix-1988; yellow pan trap; J. D. Pinto. *Maryland:* Patuxent Research Sta. (Prince Georges Co.); 1 ♂, 2 ♀; vi/viii-3-1986; Malaise trap; D. B. Wahl. *Ohio:* Euclid (holotype of *B. fidae*). *North Carolina:* Jackson, 7 km S. (Northampton Co.); 1 ♀; x-23/xi-15-1987; flight intercept

trap in bald cypress swamp; BRC Hym. Team. *Pennsylvania:* Wilawana (Bradford Co.); 1 ♀; vii-21-1991; R. H. Crandall. *Texas:* Ben Bolt, 8 mi. W. (La Copita Research Sta., Jim Wells Co.); 2 ♀; v-20-1987; J. B. Woolley. *Inks Lake State Pk.* (Burnet Co.); 1 ♂; v-2-1987; sweeping; J. Heraty. *Presidio Co.* (Big Bend Ranch; lat. 29°30'20", long. 103°52'15"); 4400 ft.; 1 ♂; J. Woolley & G. Zolnerowich. *Presidio Co.* (Big Bend Ranch, 3.5 mi. SE. La Saucedo); 4280 ft.; 1 ♀, 1 ♂; v-19-1990; G. Zolnerowich. *Presidio Co.* (Big Bend Ranch, 2.6 mi. E. Saucedo); 4260 ft.; 1 ♀, 1 ♂; v-15-1990; G. Zolnerowich. *Virginia:* across the Potomac River from Washington D.C. [2 ♀, 2 ♂, type series of *B. cicadae* (Howard)].

Notes: *Brachista fidae* and *B. cicadae* were first synonymized by Girault (1918), although, curiously he treated the junior name as valid. This synonymy has been maintained by others (Nowicki 1936, Doutt and Viggiani 1968) and is continued here. However, verification is needed. The type



Figs. 12–14. Ovipositor (partial) of *Brachista* (dorsal view of left side) showing shape of outer plate and gonostylus. 12, *B. fidiæ*; 13, *B. efferiae*; 14, *B. fisheri*.

of *fidiæ* is represented by a badly damaged specimen and has been at least since 1911 when it was first examined by Girault. That the species occurring on *Fidia* and *Magi-cicada* are the same should be confirmed by additional collecting from both hosts in eastern North America.

The female from Anza Borrego State Park, California, is tentatively assigned here. It is similar to *B. fidiæ* in all respects except the outer plate of the ovipositor is somewhat longer and the gastral apodemes are broadly curved rather than straight.

Brachista efferiae, NEW SPECIES

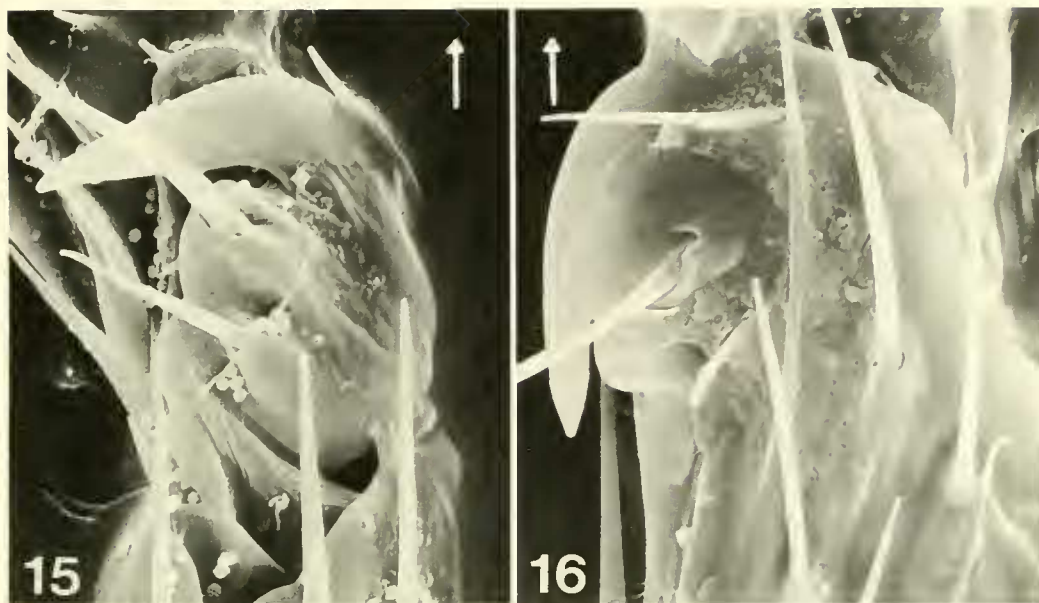
As in *B. fidiæ* with following differences:

Female: Antenna with C4 relatively symmetrical, unmodified, subconical, without pale, curved apicoventral setae on C4 (cf. Figs. 5, 7). Forewing with setation on

disc darker, more distinct; premarginal vein typically with 2 strong setae. Claws strongly decurved, parallel to longitudinal axis of leg, more distinctly sclerotized, lobe subtending claw large, fused along basal $\frac{2}{3}$ of ventral surface of claw (cf. Figs. 15, 16). Ovipositor shorter, only ca. 0.2 length of gaster, 0.49–0.58 hind tibial length (HTL) (in specimens HTL ranging from 0.14–0.19 mm); outer plate (tergum IX) with a distinct postero-lateral emargination; gonostylus much broader (cf. Figs. 12, 13).

Male: Antennal club with shorter, more robust setae than in female. Genitalia as in Fig. 11, length 0.53 that of hindtibia, somewhat broader apically than at base. Claws modified structurally as in female.

Other traits (females): Longest seta on club 1.10–1.39 length of C3. Forewing 0.47–0.49 as wide as long, length of longest fringe



Figs. 15, 16. Claws (hind leg) of *Brachista*. 15, *B. fidae* (4800 \times); 16, *B. efferiae* (4800 \times). Arrows parallel to longitudinal axis of leg.

setae 0.18–0.20 maximum wing width. Femora not inflated (Fig. 8); hindfemur width ca. 0.4 its length. Gastral apodemes as in *B. fidae*, well developed, attaining basal half of segment VI. Outer plate of ovipositor with medial projection usually evenly arcuate (Fig. 13).

Diagnosis: The unmodified antennal club in females, the more lateral emargination of the ovipositor's outer plate, and the strongly decurved claws separate this species from *B. fidae*. It is separated from *B. fisheri*, n. sp. by the well developed gastral apodemes, less swollen femora (cf. Figs. 8, 9), and broader fore wing (cf. Figs. 3, 4). The latter two are not completely separable by the different shape of the outer plate indicated in Figs. 13, 14. A few females of *B. efferiae* cannot be distinguished from *B. fisheri* for this character.

Type information: Holotype ♀. MEXICO. Tamaulipas; Cd. Victoria, 14 mi S.; vi-29-1970; attached to specimen of *Efferia texana* (Banks); E. M. & J. L. Fisher, collrs.; slide mounted in Canada balsam; deposited

in United States National Museum (USNM). Nine paratype ♀ taken from the same asilid as holotype deposited as follows: Canadian National Collection, Ottawa (1 on slide, 1 on card), British Museum (Natural History) (1 on slide, 1 on card), USNM (1 on card), University of California, Riverside (2 on slide, 2 on card).

Etymology: The specific name is in reference to the phoretic relationship of this species with robberflies of the genus *Efferia*.

Hosts: Unknown; phoretic on *Efferia* robberflies (see below).

Geographic distribution: Southern United States, south to Costa Rica; British Virgin Islands.

Records: 94 ♀, 2 ♂. BRITISH VIRGIN ISLANDS. *Guana Island*: Guana Peak; 245 m; 2 ♀ on *Efferia stylata* (Fab.); x-12-1991; R. R. Snelling. "Hotel area"; 7 ♀ on two specimens of *Efferia stylata*; x-5-1991, x-15/16-1992; R. R. Snelling. COSTA RICA. *Heredia*: Puerto Viejo (La Selva Biol. Sta.); 2 ♀ on *Efferia* nr. *argentifascia* (Enderlein); iii-27-1988; H. A. Hespeneheide. GUATE-

MALA. *Zacapa*: Zacapa, 7 km S.; 2 ♀ on *Efferia* nr. *quadrinaculata* (Bellardi); vii-5-1977; E. M. Fisher. MEXICO. *Baja California Sur*: La Burrera, 2.5 mi. E.; 1800 ft.; 10 ♀ on *Efferia* nr. *rapax* (Osten Sacken); x-20/21-1972; E. M. & J. L. Fisher. Las Barracas, ca. 30 km E. Santiago; 10 ♀, 1 ♂; 10 dates in 1984–86 from v-5 to vi-26; yellow pan traps; P. DeBach. Rancho Buena Vista; x-16-1972; 1 ♀ on *Efferia* sp. #5 (*anomala* group); E. M. & J. L. Fisher. *Chiapas*: El Jacote, 6 km NW.; 610 m; 1 ♀ on *Efferia bimaculata* (Bellardi); vii-1-1977. *Guerrero*: Iguala, 13 km NNW; 1035 m; 1 ♀ on *Efferia bimaculata* or near; vii-6-1979; E. M. Fisher & P. Sullivan. Taxco, 15 km NE.; 1650 m; 2 ♀ on *Efferia* sp. #1 (*albibarbis* group); viii-6-1977; E. M. Fisher & P. Sullivan. *Hidalgo*: Jacala, 13 km NE.; 1570 m; 1 ♀ on *Efferia* nr. *cingulata* (Bellardi); vi-24/25-1977; E. M. Fisher *Jalisco*: Jacotepec, 11 km SE. (jct. Hwy 15); 1450 m; 1 ♀ on *Efferia* nr. *sagax* (Williston); vi-28-1975; E. M. Fisher. *Magdalena*, 25 km NW.; 1 ♀ on *Efferia triton* (Osten Sacken); vi-24-1981; E. M. Fisher. *Morelos*: Canon del Lobos, 3 mi W. Yautepec; 3 ♀ on *Efferia anomala* (Bellardi) & *Efferia* sp. #3 (*anomala* group); vii-12/13-1970; E. M. Fisher & P. Sullivan. *Michoacan*: Canas, 11 km SW.; 300 m; 1 ♀ on *Efferia* sp. #2 (*albibarbis* group); vi-29-1975; E. M. Fisher. *Nayarit*: Ixtlan del Rio, 7 mi. W.; 1 ♀ on *Efferia sagax*; iii-1-1971; E. M. Fisher. *Nuevo Leon*: Huasteca Cyn. (in dry wash); 3000 ft.; 12 ♀ on *Efferia texana* (Banks); vi-17/18-1982; R. L. Aalbu. *Oaxaca*: El Camaron, 20 mi. E.; 5 ♀ on *Efferia* nr. *sagax*; vii-21-1956; D. Linsdale. La Ceiba (8 km NW. Totolapan); 1 ♀ on *Efferia* sp. #4 (*anomala* group); vi-28-1981; E. M. Fisher. *Sinaloa*: Rio Elota at Hwy. 15; 1 ♀ on *Efferia triton*; viii-10-1979; E. M. Fisher. Rio Piaxtla at Hwy. 15; 1 ♀ on *Efferia triton*; vii-24-1971; E. M. Fisher. *Tamaulipas*: Cd. Victoria, 14 mi. S.; 10 ♀ (type series on *Efferia texana*, see Type information). Cd. Victoria, 24 km S.; 500 m; 6 ♀ on 3 specimens of *Efferia* nr. *grandis*

(Hine); vi-23-1977; E. M. Fisher. UNITED STATES. *Arizona*: Chiricahua Mts. (Southwestern Research Sta., Cave Creek Cyn.); 5350 ft.; 1 ♀ on *Efferia willistoni* (Hine); viii-18-1980; N. E. Woodley. Chiricahua Mts. (Cave Creek Cyn.); 1 ♀ on *Efferia jubata* (Williston) at black light; ix-20-1967; R. E. Silberglied. Cochise; 1 ♀ on *Efferia willistoni*; viii-9-1962; J. Wilcox. Cochise Stronghold (12 mi. W. Pearce); 1 ♀ on *Efferia albibarbis* (Macquart); viii-13-1971; J. D. Pinto. Douglas, 30 mi. E.; viii-22-1986; 2 ♀ on *Efferia similis* (Williston); L. D. Anderson. Jhuse Cyn. (Cochise Co.); viii-11-1967; 1 ♀ on *Efferia similis*; F. G. Andrews. Kofa Mts. (Palm Cyn.); 1 ♀ on *Efferia imperialis* Forbes; viii-31-1982; E. M. Fisher. Portal (ca. 5–6000 ft.); 1 ♀ on *Efferia similis*; vii-30-1973; S. I. & S. L. Frommer. Santa Rita Mts. (Madera Cyn. at Santa Rita Lodge); 4880 ft.; 1 ♀ on *Efferia willistoni* at UV light; R. Beard. *Maryland*: Patuxent Research Sta. (Prince Georges Co.); 1 ♀ in Malaise trap; vii-27/viii-3-1986; D. Wahl. *Texas*: Ben Bolt, 8 mi. W. (La Copita Research Sta., Jim Wells Co.); 1 ♂; v-20-1987; J. B. Woolley. Center Point (Kerr Co.); 1 ♀; vi-19/25-1987; W. Wharton.

Notes: Most of the *Efferia* cited above are in the collection of E. M. Fisher. A few are housed at the University of California, Riverside.

Brachista fisheri, NEW SPECIES

Differing from *B. fidae* in same characters as *B. efferiae*. Separated from the latter as follows:

Female: Slightly darker. Antennal club with slightly longer setae, longest seta 1.32–1.60 length of C3. Fore wing with setae on membrane darker, longer, fore wing narrower and with longer fringe: 0.37–0.42 as wide as long; longest fringe setae 0.35–0.41 maximum wing width (cf. Figs. 3, 4). Legs more robust, shorter; femora more distinctly inflated, width of hind femur at least 0.5 its length (Figs. 8, 9). Ratio of ovipositor length to hind tibial length similar but both

structures slightly shorter in *B. fisheri*. Outer plate of ovipositor with a subangulate medial projection (Fig. 14). Gastral apodemes obsolescent, very thin, only attaining apex of segment VI.

Male: Unknown.

Diagnosis: The obsolescent gastral apodemes, the narrow fore wing with more elongate fringe setae, and the more robust femora separate this species from congeners.

Type information: Holotype ♀, BRAZIL. Rondina; Fazenda Rancho Grande; 62 km S. Ariquemes; 165 m; 12/22 November 1991; attached to a female of *Efferia* sp. #6 (*aestuans* group); E. M. Fisher, collr.; in United States National Museum (USNM).

Another female from the same *Efferia*, and seven females from a second female *Efferia* (data same as holotype except L. G. Bezark & D. E. Russell collrs.) designated as paratypes. These are deposited as follows: Canadian National Collection, Ottawa (1 on card); University of California, Riverside (3 on slides, 3 on cards); Museo La Plata, La Plata, Argentina (1 on slide).

Etymology: This species is named for Dr. Eric M. Fisher, the primary collector of phoretic *Brachista*.

Hosts: Unknown; phoretic on *Efferia* robberflies (see below).

Geographic distribution: Ronderas, Brazil.

Records: 9 ♀ from Ronderas, Brazil (see type information).

Notes: The two *Efferia* cited above are in the collection of E. M. Fisher.

Relationships.—*Brachista efferiae* and *B. fisheri* are most closely related. Similarities contrasting with *B. fidiæ* include phoresy on *Efferia* robberflies, strongly decurved claws (clearly a derived feature), shortened ovipositor, and shape and size of the outer plate of the ovipositor. The reduced gastral apodemes in *B. fisheri* is unique for the genus and is presumably a reversal.

Brachista efferiae and *B. fideae* appear to be sympatric throughout much of their range

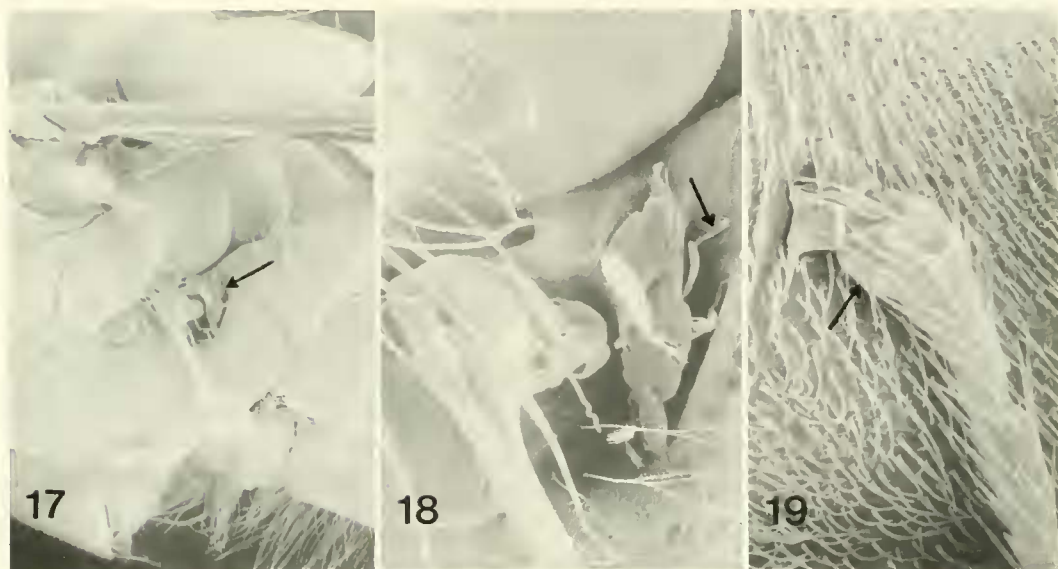
from southern United States south to Central America. Both species were collected together at the Patuxent Research Station, Maryland; and 8 mi. W. Ben Bolt, Texas.

Phoresy in Brachista.—The two new species, *B. efferiae* and *B. fisheri*, have been collected primarily from adults of *Efferia* robberflies and it is probable that eggs of these flies serve as hosts. *B. fisheri* is known only from 9 females—all collected from two *Efferia* females. Of the 96 specimens of *B. efferiae* known, 82, all females, were taken from 38 museum specimens of *Efferia*; 11 females and 1 male were collected in yellow pan and Malaise traps; 1 male and 1 female were collected without indication.

Females of *Brachista efferiae* were found on both male (23) and female (15) flies. Most flies (22) had only a single wasp attached; 7 flies had 2, 4 flies had 3, 1 had 4, 1 had 5, 1 had 7, 1 had 10, and 1 had 12. Wasps were all positioned near the base of the halteres between the thorax and abdomen either on the anatergite or, less commonly, on epimeron-3 (Figs. 17, 18). This region appears to be well protected from removal or damage by objects in the environment and the asilid's grooming behavior. Most wasps were directed with head toward the ventral or lateral aspect of the fly. They occurred on the right or left side of flies in almost equal frequency, and were attached to both sides of five of the 16 flies harboring more than one wasp.

The position of the relatively few *E. fisheri* on flies differed from that of *E. efferiae*. Ten specimens, all females, were collected from two females of *Efferia*. Two were on one fly, 7 were on the second. Only one of these was positioned on the anatergite, the most common site of attachment for *B. efferiae*. The others were positioned almost equally on the posterior rim of the scutellum, and on the posterior surface of the postalar callus. *B. efferiae* was never found on these structures.

All asilids harboring wasps were killed in cyanide and then pinned. The relatively



Figs. 17–19. *Brachista efferiae* attached to a specimen of *Efferia* nr. *grandis* (24 km S. Cd. Victoria, Tamaulipas, Mexico). 17, 15 \times , arrow pointing to *Brachista* at base of haltere (anterior end of asilid to left, dorsum at top); 18, same, 65 \times , arrow pointing to hind tarsus enlarged further in Fig. 19; 19, 900 \times , showing hind tarsus of *Brachista* on surface of *Efferia* (arrow pointing to decurved claw).

constant position of the *Brachista* on these flies suggests that they moved little or not at all before death.

It is assumed that the modified claws in *B. fisheri* and *B. efferiae* are somehow related to phoretic behavior. The apical segment of the tarsi of dead wasps are in contact with the tomentum-covered surface of the *Efferia* but it appears that primary contact is made with the arolium and not the claws. The strongly decurved nature of the claws removes them from the surface of the fly and may allow more intimate contact by the arolium (Fig. 19).

Most aspects of the relationship between *Brachista* and *Efferia* are unknown. It is not clear where wasps encounter flies, if wasps on male flies switch to females during mating (known to last several minutes in *Efferia* [Dennis et al., 1986]), or if the asilid actually is utilized as a host and not simply as a mode of dispersal. Thus far, only one species of trichogrammatid, *Soikiella mongibelli* Nowicki, has been recorded as a parasite of asilids (Velten and Pinto 1990). This species

is not known to be phoretic, and is not closely related to *Brachista*.

Brachista were found on approximately 22 species of *Efferia*. These are assigned to five of the eight species groups recognized by Wilcox (1966). According to Dr. Eric Fisher (pers. comm.) all of these species probably oviposit in vegetation as opposed to soil. Collections indicate that wasps are found only on a small percentage (<5%) of the *Efferia* in the southwestern United States and Mexico. The 38 specimens harboring the *Brachista* for this study were among several hundred flies examined.

Phoresy has been recorded in two other unrelated genera of Trichogrammatidae. *Pseudoxenus fersythi* Yoshimoto (as *Xenus* nr. *ruskini* Girault) was collected in Ecuador from the hind wings of the nymphaled *Caligo eurilochus* (Cramer) (Malo 1961), and on the abdomen of the brassolid *Opisphanes cassina* Feld. (Yoshimoto 1976). This wasp is known to utilize *C. eurilochus* as a host (Malo 1961). A species of *Oligosita*, *O. xiphidii* Ferriere, was found on hind

wings on the orthopteran *Conocephalus longipenne* (de Haan) in Sumatra and Java (Ferrière 1926). Another *Oligosita*, *O. brevicilia* Girault, was similarly associated with *Neoconocephalus* sp. in Argentina (De Santis and Cicchino 1992). Host associations between the species of *Oligosita* and the Orthoptera were not established.

There are two commonalities to examples of phoresy in the Trichogrammatidae: (1) only female wasps are recorded as phoretic, (2) wasps are found on both sexes of the carrier species.

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